Draft Recontamination Evaluation Work Plan

ZIDELL WATERFRONT PROPERTY

ECSI NO. 689

Prepared for

ZRZ REALTY COMPANY

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Project No. 8014.01.21

Prepared by

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DRAFT RECONTAMINATION EVALUATION WORK PLAN

ZIDELL WATERFRONT PROPERTY, ESCI NO. 689

The material and data in this work plan were prepared under the supervision and direction of the undersigned.

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TABLES AND ILLUSTRATIONS

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FOLLOWING WORK PLAN:

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BMP	best management practice
City	City of Portland
COCs	chemicals of concern (including chemicals of ecological concern)
CRT-N	northern crane rail track
CRT-S	southern crane rail track
DEQ	Oregon Department of Environmental Quality
FS	feasibility study
LWG	Lower Willamette Group
MFA	Maul Foster & Alongi, Inc.
NPDES	National Pollutant Discharge Elimination System
OHW	ordinary high water
PAH	polycyclic aromatic hydrocarbon
PCB	polychlorinated biphenyl
RA	remedial action
RI	remedial investigation
ROD	Record of Decision
SCM	source control measures
SMA	sediment management area
TBT	tributyltin
Zidell	ZRZ Realty Company, Zidell Marine Corporation, and Tube Forgings of America, Inc.

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1 INTRODUCTION

1.1 Introduction

Maul Foster & Alongi, Inc. (MFA) has prepared this Draft Recontamination Evaluation Work Plan on behalf of ZRZ Realty Company, Zidell Marine Corporation, and Tube Forgings of America, Inc. (collectively referred to as Zidell) to present an approach for evaluating the potential for recontamination of the proposed remedial action sediment cap due to stormwater discharges from the Zidell Waterfront Property located at 3121 SW Moody Avenue in Portland, Oregon (see Figure 1).

1.2 Background

On April 14, 1995, Zidell entered into a Voluntary Agreement with the Oregon Department of Environmental Quality (DEQ) to conduct a remedial investigation (RI) and feasibility study at the site (DEQ No. WMCVC-NWR-94-23; ECSI No. 689). The RI was completed in 2003 (MFA, 2003) and the FS was completed in 2004 (MFA, 2004). The remedial action (RA) was selected by the DEQ in the Record of Decision (ROD) (DEQ, 2005), in accordance with Oregon Revised Statutes 465.200 through 465.380 and Oregon Administrative Rules Chapter 340, Division 122, Section 0090. The remedy selected by the DEQ includes excavation and disposal of soil exceeding hot spot concentrations, placement of a cap over bank and upland soil, and placement of a cap over contaminated sediments in the Willamette River adjacent to the site. The September 12, 2006 General Judgment on Stipulation and Consent, Case No. 0609-09344 (Consent Judgment), between the State of Oregon and Zidell, requires that Zidell complete the selected remedial action (RA) and includes a schedule for implementation.

The ROD and Consent Judgment require source control measures (SCMs) to protect the Willamette River from potential releases of hazardous substances before implementation of the remedy and during Zidell's continued barge-building operations. Several source control measures were proposed in the 2007 Interim Source Control Measures Plan (MFA, 2007a) and the 2007 Source Control Supplemental Assessment (MFA, 2007b) and implemented in 2008.

Stormwater runoff from the site discharges to the Willamette River through two private outfalls, a City of Portland (City) outfall, and via sheet flow. Initial stormwater SCMs designed to reduce contaminant concentrations in stormwater effluent were implemented at the site in 2007 (MFA, 2008b). Additional stormwater SCMs were identified and designed in 2008 and implemented between November 2008 and January 2009 (MFA, 2009).

Stormwater monitoring pursuant to a National Pollutant Discharge Elimination System (NPDES) permit issued to Zidell has been an ongoing operational activity at the site. Additional stormwater monitoring has been conducted in accordance with the DEQ-approved stormwater sampling plan (MFA, 2009) to evaluate the adequacy of the implemented stormwater source control measures.

1.3 Purpose

The purpose of the recontamination evaluation is to assess the potential for recontamination of the proposed sediment cap from Zidell's three private stormwater discharges to the Willamette River (slipway sheet flow, Outfall 1 and Outfall 2). Zidell has implemented numerous best management practices, housekeeping measures, SCMs and improvements to the stormwater system to reduce the contaminant loads discharging to the Willamette River with stormwater runoff. The recontamination evaluation will assess the effectiveness of the implemented SCMs, and if necessary, identify the need for additional SCMs.

This recontamination evaluation addresses Zidell stormwater discharges only and does not evaluate the potential for recontamination of the Zidell cap from the City outfalls discharging over the proposed cap, upstream or downstream sources, groundwater flows or atmospheric deposition. Zidell understands that the DEQ will work with the City to evaluate the potential for recontamination of the cap resulting from stormwater discharges from City outfalls.

1.4 Objectives

The objectives of the draft WP are to:

- define "recontamination" with respect to specific screening levels and establish a point of compliance;
- identify the data needs for the recontamination evaluation and outline the proposed data collection methods;
- propose methods and models for estimating stormwater runoff volumes, contaminant of concern (COC) and solids loading in stormwater effluent, and COC concentrations in surface sediments over time after the RA is completed;
- provide an example calculation of recontamination potential to demonstrate the methodology.

1.5 Definition of Recontamination and Compliance Point

1.5.1 Sediment Cleanup Levels and Cap Boundary Determination

Cleanup levels for bulk sediment are established in the ROD (DEQ, 2005)[1]. The sediment cap boundary was generally configured to include sample locations in the

[1] The cleanup level for tributyltin (TBT) was revised to 2.3 µg/kg subsequent to the ROD (DEQ, 2007).

sediment management area where COC concentrations were above the sediment cleanup levels. Ambient levels of polychlorinated biphenyls (PCBs) in sediment (10 to 20 micrograms per kilogram [μg/kg], as specified in the ROD) in this stretch of the Willamette River exceed the cleanup level. It is therefore not practical to cap all sediment where PCBs concentrations in sediment exceed the cleanup level. The cap boundary was configured such that, following completion of the cap, area-weighted average PCBs concentrations, inside and outside of the SMA (i.e., within the subject study area), will be within the range of ambient levels (10 to 20 μg/kg).

1.5.2 Recontamination

For the purposes of this modeling effort, the sediment cap will be considered recontaminated if or when the concentrations of COCs other than PCBs in surface sediments within the cap boundary are predicted to exceed the cleanup levels. For PCBs, the cap will be considered recontaminated if or when the concentrations of surface sediments within the cap boundary are predicted to significantly exceed the ambient sediment levels.

1.5.3 Compliance Point

For the purposes of this modeling effort, the compliance point is considered surface sediment (i.e., sediment accumulated on top of the armored cap surface) within the sediment cap boundary.

2 ZIDELL STORMWATER SYSTEM

Stormwater runoff from the operational areas of the site (south of the Ross Island Bridge) infiltrates into the ground surface, sheet-flows into the Willamette River, or discharges to the river through one of three outfalls (two private outfalls and City Outfall 6). This recontamination evaluation addresses Zidell stormwater discharges only, including the two private outfalls and sheet flow discharging to the Willamette River. Zidell plans to eliminate discharges from the site to City Outfall 6 and therefore, the potential for recontamination of the Zidell cap from Zidell's stormwater discharges to the City outfall discharging over the proposed cap is not assessed as part of this evaluation.

2.1 Zidell Outfall 1 Stormwater System

Zidell Outfall 1 is the southernmost outfall at the site and is located north of the barge slipway (see Figure 2). Drainage Area 1, shown on Figure 2, drains into Zidell Outfall 1 and consists of the largely impervious area west and southwest of the barge building. It also includes the central section of the barge building roof. Stormwater runoff from this area infiltrates through alligatored pavement and the western portion of the northern crane rail track (CRT-N) channel, or is collected in a catch basin (CB-1A) and manhole with a slotted lid (MH-1A) and conveyed to Outfall 1 (see Figure 2). CB-1A and MH-1A are equipped with catch basin filters. A roof downspout that collects runoff from the central section of the barge building roof runs down one of the interior columns of the building and ties into the 18-inch pipe discharging to Zidell Outfall 1. MH-1D is the most downstream location on the Outfall 1 line; all future stormwater samples for this outfall will be collected from MH-1D.

2.2 Zidell Outfall 2 Stormwater System

Zidell Outfall 2 is located approximately 230 feet north of Zidell Outfall 1 and drains Drainage Area 2, which includes the northern section of the barge building roof and part of the material storage area north of the barge building (see Figure 2). The ground surface in Drainage Area 2 is mostly impervious, with the exception of a small pervious area in the northwest corner, where there is no pavement. Stormwater runoff from Drainage Area 2 is collected through two manholes with slotted lids (MH-2A and MH-2B) and conveyed to Zidell Outfall 2 (see Figure 2). MH-2A and MH-2B are equipped with catch basin filters. Stormwater samples for Zidell Outfall 2 are collected directly from the outfall pipe.

2.3 Barge Assembly Area Stormwater System

Stormwater runoff from the barge assembly area and most of the runoff generated from the southern section of the barge building roof (Drainage Area 3) drain into one of two channels (CRT-N and CRT-S) running along the crane rail tracks (see Figure 2). CRT-N is located on the north side of the barge assembly concrete slab, between the slab and the barge building (see Figure 2). CRT-S runs along the south side of the barge assembly concrete slab. The channels are relatively flat and have been improved to enhance infiltration and minimize the potential for discharges from the channels to the slipway and the Willamette River. Runoff from the eastern section of the barge assembly area sheet-flows toward the slipway and the river, following filtration through a log-type sediment filter and sheet flow filters equipped with metals-removal media, located on the eastern edge of the barge assembly area slab. A slipway sampling point collects representative samples of the filtered sheet flow and allows for easy sample collection. The quantity of discharge to the slipway will vary depending on the stage of the barge construction (i.e., smaller volumes of stormwater are anticipated from storm events that occur when the barge is near completion and covers most of the barge assembly area, as stormwater that drips off the barge will be routed into the CRT channels, not the slipway).

2.4 Areas Currently Discharging to City Outfall 6

Stormwater runoff from the parking lot north of the office building and the raw materials storage area northeast of the office building (see Drainage Area 5, Figure 2) drains to a few scattered pervious areas and infiltrates or is collected through one of two catch basins (CB-5A and CB-5B) and is conveyed to City Outfall 6.

Stormwater runoff from the driveway, the south section of the office building roof, and the parking lot located south of the office building (see Drainage Area 4, Figure 2) discharges to a pipe that runs north under the office building. Zidell has been unable to trace the line beyond the building, however it is most likely that the line ties into City Outfall 6.

The City is currently evaluating the feasibility and costs of decommissioning Outfall 6, and is coordinating with Zidell on this effort. Zidell plans to design an alternative method to manage stormwater from these areas, in coordination with the City and DEQ. For the purpose of the recontamination evaluation, it is assumed that stormwater from this area will be managed via surface infiltration, eliminating discharges to the Willamette River from this portion of the site. If this assumption is incorrect, the potential for recontamination from these discharges will be evaluated and a separate work plan will be prepared to outline the approach.

3 RECONTAMINATION EVALUATION APPROACH

This section outlines the overall approach for evaluating the potential for recontamination of the sediment cap. Figure 3 presents a graphic showing the overall recontamination approach.

In general, it has been conservatively assumed that all suspended solids discharged from the site are deposited within the depositional area in the northern part of the sediment cap boundary. If unacceptable levels of recontamination are modeled using these conservative assumptions, Zidell may submit an addendum to this work plan to incorporate more detailed evaluations, possibly including a mixing zone evaluation.

3.1 SEDCAM Model

SEDCAM is a steady-state mathematical model developed to evaluate natural recovery of contaminated sediments. It is useful as a screening-level model and allows for a more cost-effective demonstration of recontamination potential than more complex 3-dimensional modeling studies. When used in conjunction with the models and calculations described in this work plan, SEDCAM may be applied, using an Excel platform, to predict COC concentrations in surface sediments over a specified time period, taking into account the effects of sedimentation, mixing, and biodegradation (Jacobs et al. 1988). SEDCAM simplifies the various processes that contribute to chemical changes in surface sediments (e.g., assumes a well-mixed surface sediment layer), however the model accounts for the effects of the most important processes affecting the changes in chemical concentrations in the mixed sediment layer (e.g., sedimentation) and is proposed for use in the recontamination assessment in the Portland Harbor (NewFields, 2009).

The model estimates COC concentrations in surface sediments (i.e., a mixed layer of a specified thickness) by considering the initial conditions (i.e., COC concentrations in the cap material) and changes in COC concentrations with time due to accumulation of sediment from upstream sources and stormwater discharges, as well as chemical degradation.

The original SEDCAM equation (Jacobs et al. 1988) was modified to better fit the data available for the Zidell site, as well as Portland Harbor sites (NewFields, 2009):

$$C_{COC}(t) = \frac{1}{(1+k\times Ts)} \times C_{COC,sed} \times \left(1 - e^{\frac{-(1+kTs)\times t}{Ts}}\right) + C_{COC}(0) \times e^{\frac{-(1+kTs)\times t}{Ts}}$$

$C_{COC}(t)$ = COC concentration in surface sediment mixed layer at time t (COC mass/sediment mass)

$C_{COC,sed}$ = weighted average COC concentration in sediment deposited over cap area (COC mass/sediment mass)

$C_{COC}(0)$ = average COC concentration of cap material immediately after placement (COC mass/sediment mass)

k = combined first-order decay and diffusion rate constant for COC loss (yr^{-1})

t = time (years)

$T\mathrm{s} = \frac{ML}{S_{net}}$

ML = mixed layer depth (cm)

S_{net} = net sedimentation rate (cm/yr)

Section 4 describes the above input values for the Zidell site in detail.

4 SEDCAM MODEL INPUT PARAMETERS

This section defines the input parameters necessary to run the SEDCAM model and references sections of the work plan that discuss each parameter in detail.

4.1 COC Concentrations in Deposited Sediment

The weighted average COC concentrations in sediment deposited over the cap area ($C_{COC,net}$) are calculated using weighted average COC concentrations in stormwater solids discharging through the three Zidell discharge points and potentially settling over the cap ($C_{COC,storm}$), the ambient concentrations of COCs in upstream sediment ($C_{COC,upstream}$) and the respective sedimentation rates of stormwater solids (S_{storm}) and upstream sediment ($S_{upstream}$).

$$C_{COC,net} = \frac{C_{COC,storm} \times S_{storm} + C_{COC,upstream} \times S_{upstream}}{S_{storm} + S_{upstream}}$$

4.1.1 COC Concentrations in Stormwater Solids

The weighted average concentration in stormwater solids discharging from the site and potentially settling over the cap area ($C_{COC,storm}$) is calculated using the geometric mean concentrations of COCs in stormwater effluent from each discharge point ($C_{COC,OF1}$, $C_{COC,OF2}$, and $C_{COC,Slip}$), mass loading of solids from each discharge point ($M_{TSS,OF1}$, $M_{TSS,OF2}$ and $M_{TSS,Slip}$), and the annual runoff volume from each outfall (RO_{OF1}, RO_{OF2}, and RO_{Slip}).

$$C_{COC,storm} = \frac{C_{COC,OF1} \times RO_{OF1} + C_{COC,OF2} \times RO_{OF2} + C_{COC,Slip} \times RO_{Slip}}{M_{TSS,OF1} + M_{TSS,OF2} + M_{TSS,Slip}}$$

Annual Runoff Volumes

Rainfall data will be obtained from the Portland HYDRA Network Thomas Raingage, located at 4026 SW Macadam Avenue (http://or.water.usgs.gov/non-usgs/bes/thomas.rain). The 50th percentile flow year, 2002, will be used to estimate average annual runoff volume discharging to the Willamette River from Zidell (Anchor QEA, 2009).

The runoff volume and solids loading in stormwater will be estimated using the Simple Method (Schueler, 1987). The Simple Method is a mathematical equation that is appropriate for smaller watersheds (less than 640 acres). It is being used in the Portland Harbor Draft Remedial Investigation Report (LWG, 2009) to estimate stormwater loads for use in contaminant loading calculations and is applicable for estimating runoff volumes and COC loading at Zidell.

The annual runoff volume was calculated as follows:

$$RO = P \times R_v \times 0.9 \times A_{basin}$$

RO = annual runoff volume (cubic feet)
P = annual rainfall (feet)
R_v= runoff coefficient (unitless)
A_{basin} = area of drainage basin (square feet)
0.9 = standard factor representing the fraction of rainfall that produces runoff (unitless)

$$R_v = 0.05 + 0.9 \times I_a$$

I_a= impervious fraction of the drainage basin

As noted above, the 50th percentile flow year was used to calculate the annual rainfall. The 2002 water year (October 1, 2002 through September 30, 2003) was used, as this resulted in a more conservative (i.e., higher) annual rainfall than the 2002 calendar year.

Table 4.1 below summarizes the drainage areas for each Zidell outfall.

Table 4.1 Drainage Basins

Drainage Area	Area (square feet)
Outfall 1	94,090
Outfall 2	118,919
Slipway	73,616

The portion of the barge assembly area that has the potential to drain to the slipway when a barge is not present is 147,233 square feet. For most of the year, however, the barge or a portion of the barge covers this area and stormwater from the covered portion is infiltrated in one of two CRT channels. When the barge body is near completion and during typical storm conditions, discharges to the slipway are not observed. Therefore, the average area annually discharging to the slipway is assumed to be 73,616 square feet, or half of the potential drainage area.

COC Mass Loadings

This recontamination analysis evaluates the potential for recontamination from Zidell's current operations. Although it is likely that the quality of stormwater effluent will continue to improve, as the technology, operations and maintenance of implemented SCMs improve, the evaluation conservatively assumes no future trends in the effluent quality. Geometric mean concentrations of COCs in stormwater samples collected during the 2009/2010 sampling period (i.e., period following the implementation of all site SCMs) for each discharge point will be used. Since dissolved-phase COCs present a relatively low potential to recontaminate the proposed sediment cap compared to particle-bound COCs, only the suspended (i.e., settleable) portion of total COCs concentrations will be used in the mass loading calculations. Where data is available (e.g., metals), the suspended COC concentration will be calculated as the total COC concentration minus the dissolved COC concentration.

For each outfall, the average annual COC mass load will be estimated as the product of the annual runoff volume and the mean COC concentrations in stormwater effluent.

$$COC_{load,OF} = C_{COC} \times RO_{OF}$$

$COC_{load,OF}$ = annual COC mass load for specific Zidell outfall (mass/year)

C_{COC} = geometric mean COC concentration in stormwater effluent (mass/volume)

RO_{OF}= annual runoff volume for specific Zidell outfall (volume)

The COC mass loads from each outfall will be summed to generate a total mass load for each COC.

$$COC_{load,net} = COC_{load,OF1} + COC_{load,OF2} + COC_{load,Slip}$$

Solids Mass Loadings

For each outfall, the average annual TSS mass load will be estimated as the product of the annual runoff volume and the geometric mean TSS concentration in stormwater effluent. The solids mass loadings for each outfall were summed to generate a net mass load of solids discharged with stormwater on an annual basis.

$$TSS_{load,OF} = RO_{OF} \times CTSS$$

$$TSS_{load,net} = TSS_{load,OF1} + TSS_{load,OF2} + TSS_{load,Slip}$$

4.1.2 COC Concentrations in Upstream Sediment

The ambient concentrations of sediment upstream of the site ($C_{COC,upstream}$) are an important factor in evaluation recontamination, as the quantity of sediment deposited from upriver is significantly greater than the quantity of solids deposited with stormwater. Ambient COC concentrations in sediment established in the ROD will be used to assess the potential for recontamination. For COCs for which the ROD does not list ambient concentrations, data collected by the LWG or other recently published data will be used in the evaluation.

The ambient concentration of PCBs established in the ROD was 10 to 20 μg/kg. The sensitivity to this range of values will be evaluated and is further discussed in Section 6.8.3.

4.1.3 Sedimentation

The net annual sedimentation rate is the sum of the rate of sediment deposited from upriver and the rate of solids deposited with stormwater effluent. Sediment is assumed to be deposited in the estimated depositional area, quantified and delineated by comparing historical and current bathymetric surveys of the waterway (MFA, 2008). The depositional area is approximately 280,452 square feet and approximately 138,753 square feet of the depositional area lie within the sediment cap boundary. Approximately 1 to 4 feet of sediment was deposited over the depositional area over eight years for which detailed bathymetric surveys of this stretch of the river exist. These sedimentation depths will be converted to annual sediment mass loading using published sediment density values or site-specific bulk sediment density, if available, and the depositional area surface. The extent of the estimated depositional area is shown on Figure 4.

Sedimentation Rate for Solids Deposited with Stormwater

The sedimentation rate for stormwater solids equals the stormwater solids load deposited over the depositional area will be estimated using the average TSS concentrations in stormwater samples (C_{TSS}), and the average annual runoff volume (RO).

$$S_{storm} = TSS_{load} = RO \times CTSS$$

The solids load calculation conservatively assumes that all of the solids discharged with stormwater will settle over the depositional area.

Sedimentation Rate for Sediment Deposited from Upstream

The net sedimentation estimate generated from comparison of historical and current bathymetric surveys includes deposited sediment from both upstream sources and stormwater outfalls; the sedimentation rate from upstream sources is the difference between the total sedimentation rate and the sedimentation from stormwater sources.

$$S_{net} = S_{upstream} + S_{storm}$$

And conversely:

$$S_{upstream} = S_{net} - S_{storm}$$

S_{net} = net sedimentation rate over depositional area of the cap (mass/year)

$S_{upstream}$ = sedimentation rate from upstream sources (mass/year)

S_{storm} = sedimentation rate from stormwater sources (mass/year)

4.2 Initial COC Concentrations in Cap Material

The actual initial COC concentrations in the cap material are unknown at this time and will not be available until the material supplier is selected and the material is characterized. For the purposes of the recontamination evaluation, several assumptions regarding the cap material COC concentrations will be made, as described below.

The potential for recontamination will be evaluated assuming a range of PCBs concentrations in accordance with the assumptions made in the cap chemical isolation layer model (MFA, 2009a). PCBs concentrations ranging from 1 μg/kg to 10 μg/kg will be used to assess the effect of this parameter on recontamination potential. Concentrations of the remaining COCs are assumed to be equal to the respective method detection limits, due to the lack of available data. As explained below, because the depth of the mixed layer is assumed to be minimal, the cap material COC concentrations do not have a significant impact on the results of the recontamination evaluation.

4.3 Mixed Layer

The thickness of the surface sediments mixed layer is assumed based on flow velocities, activities occurring in the water body (e.g., ship traffic), and activities of the benthic organisms that move around the sediment particles. A value between 0 and 25 centimeters (cm) is typical (Ecology, 1991). Since the Willamette River channel is subject to relatively fast currents and propeller wash, a mixed layer thickness of 25 cm is typically chosen (BBL, 2005). However, because the Zidell cap will be armored with a rock surface, a more conservative mixed layer depth will be used in the model to better represent mixing in the armored surface immediately after capping and before significant deposition. To realistically represent mixing of sediment, the mixed layer depth will be increased incrementally to model sediment mixing as sediment accumulates over the cap and armor (i.e., the model will assume an initial mixed layer depth of near zero and the depth will be increased with each time step using the estimated sedimentation rate). A sensitivity analysis will be conducted to evaluate the effect of values ranging from 0.1 cm (i.e., effectively representing no mixed layer) and 25 cm.

4.4 Time Period

The evaluation will be conducted to evaluate the potential for recontamination from current Zidell operations. The exact length of time that Zidell will continue operating at the site is unknown, and a 20 year time period will be input into the SEDCAM model to represent a conservative period of operation.

4.5 Chemical Degradation Rate

Since this recontamination evaluation will be conducted for a relatively short period of time, representing the maximum amount of time that Zidell will continue barge-building operations at the site, and because many of the site COCs degrade slowly, degradation is assumed to be insignificant and this recontamination evaluation assumes no degradation ($k = 0$).

5 STORMWATER QUALITY

This section summarizes the existing stormwater quality data and data needs.

5.1 Existing Stormwater Data and Screening

Stormwater samples have been collected, analyzed for all site COCs and screened against the non-Portland-Harbor screening level values (SLVs) outlined in Appendix D of the DEQ *Guidance for Evaluating the Stormwater Pathway at Upland Sites* since November 2007 (DEQ, 2009). A list of site-specific COCs and sampling parameters is presented below:

- Metals
  - Arsenic
  - Antimony
  - Barium
  - Beryllium
  - Cadmium
  - Chromium
  - Copper
  - Lead
  - Mercury
  - Nickel
  - Silver
  - Zinc
- Butyltins
  - Tributyltin
- PAHs
  - Benzo(a)anthracene
  - Benzo(a)pyrene
  - Benzo(b)fluoranthene
  - Benzo(k)fluoranthene
  - Chrysene
  - Dibenz(a,h)anthracene
  - Indeno(1,2,3-cd)pyrene
  - Total PAHs
- PCBs
  - Aroclor 1242
  - Aroclor 1254
  - Aroclor 1260
  - Total PCBs
- TSS[2]

Eight samples were collected between November 2007 and June 2009 from the Zidell Outfalls 1 and 2 and the slipway. A majority of these samples were collected prior to the completion of the existing SCMs and stormwater system improvements and will therefore not be used in the evaluation of recontamination potential. The samples will be used as a baseline, to evaluate trends and effects of the implemented SCMs on the quality of stormwater effluent.

The bulk of the stormwater SCMs were implemented in late 2008 and were followed by two rounds of stormwater sampling in early 2009. Zidell implemented additional

[2] TSS is not considered a COC, however TSS data is necessary to estimate the solids loadings and sedimentation rate due to stormwater discharges, therefore is included in the list of parameters to be sampled.

SCMs during the summer of 2009 (e.g., additional slipway sheet-flow filters, removal of raw steel from the Outfall 2 drainage area) to further reduce the contaminant loads in stormwater effluent.

5.2 Stormwater Quality Data Needs

Stormwater sampling criteria and methods are described in detail in the attached Stormwater Sampling Plan (Appendix A), approved by the DEQ on September 15, 2009. A minimum of four stormwater samples will be collected during the 2009/2010 sampling period, as defined in the attached Stormwater Sampling Plan, from Zidell Outfalls 1 and 2 and the slipway.

In-line sediment traps are not proposed as part of this recontamination evaluation because sediment trap installation at the outfalls is not feasible either due to the small size of the outfall (e.g., Outfall 2 measures only 6 inches in diameter) or the submerged conditions that frequently occur (e.g., Outfall 1 is frequently submerged during the rainy season). Installation of an in-line sediment trap at the slipway is also not feasible, as this area does not include a stormwater system and discharges to the river via sheet flow. Additionally, since all drainage structures at the site are equipped with catch basin filters that remove the majority of settleable solids, it is unlikely that a sufficient amount of solids would be collected in the sediment traps during the timeframe of the recontamination evaluation.

6 EXAMPLE RECONTAMINATION EVALUATION

This section presents an example recontamination evaluation to better explain the methodology outlined in the work plan. Since PCBs are likely to be the driver of recontamination, the example evaluation demonstrates an analysis of the potential for recontamination of the cap with PCBs. The example calculation utilized the most conservative assumptions showing the worst-case scenario. The calculations are presented in Excel format in Appendix B.

6.1 PBCs Concentrations in Stormwater Solids

Annual stormwater runoff volume was calculated for each of the three Zidell stormwater outfalls, per the methodology described in Section 4.1.1. An annual rainfall of 35.2 inches and the drainage areas presented in Table 4.1 generated the following annual runoff volumes:

Outfall 1 = 6,679,921 Liters

Outfall 2 = 8,442,677 Liters

Slipway = 5,226,419 Liters

The example calculation conservatively assumed that the drainage basins were entirely impervious, although some unpaved or graveled surfaces exist within these areas.

The total PCBs concentration for each sample was calculated as the sum of detections of individual Aroclors. The highest method reporting limit for any one Aroclor was used as the total PCB concentration for samples where no Aroclors were detected at or above the method reporting limit. The geometric mean total PCB concentration was calculated from the data set for each outfall.

The mean total PCBs concentration for each outfall was multiplied by the annual runoff volume for the outfall to calculate the chemical mass load of PCBs (mass/year). The mass loadings for each outfall were summed to generate a net mass load of PCBs discharged with stormwater on an annual basis.

Similar to the mass loading of PCBs in stormwater, the mean TSS concentration for each outfall was multiplied by the annual runoff volume for the outfall to calculate the mass load of solids (mass/year). The solids mass loadings for each outfall were summed to generate a net mass load of solids discharged with stormwater on an annual basis.

The net chemical mass load of total PCBs was divided by the net solids mass load to generate the weighted average total PCBs concentration in stormwater solids discharging from the site and potentially settling over the cap. The weighted average PCBs concentration in stormwater solids was calculated as 881 μg/kg.

6.2 Sedimentation

The net annual sedimentation rate was estimated from comparison of current and historical bathymetric surveys, as outlined in Section 4.1.3. The net annual sedimentation rate from stormwater was estimated from the TSS concentration and annual runoff volumes and was subtracted from the net sedimentation rate to generate the annual sedimentation rate from upstream sediments. Since the net sedimentation rates included a range of values, the most conservative value (i.e., the lowest net sedimentation rate) was used in the example calculation (i.e., 3.81 cm/year and 1,430,100 kg/yr). The sensitivity of the model to sedimentation values is discussed in Section 6.8.1 and 6.8.2.

6.3 PCBs Concentration in Deposited Sediment

The ambient concentration of total PCBs established in the ROD was 10 to 20 μg/kg. The maximum of this range (20 μg/kg) was used in the example calculation for the concentration of total PCBs in upstream sediment. The sensitivity of this parameter on model results is discussed in detail in Section 6.8.3. The weighted average PCBs concentrations in stormwater and ambient PCBs concentrations in upstream sediment were combined with the estimated sedimentation rates to generate weighted average PCBs concentration in deposited sediment. Using the 20 μg/kg concentration of PCBs in upstream sediment and the 881 μg/kg concentration of PCBs in stormwater solids, the weighted average PCBs concentration in sediment deposited annually was calculated to be 20.25 μg/kg. This shows that stormwater contributes 0.25 μg/kg PCBs annually.

6.4 Initial PCBs Concentrations in Cap Material

The example calculation conservatively assumed a PCBs concentration of 10 μg/kg in the cap material immediately after placement.

6.5 Mixed Layer

The example calculation conservatively assumed 0.1 cm thick surface sediment mixed layer. Since the equation requires that a positive value of the mixed layer thickness be input, the 0.1 cm value conservatively simulates a condition with effectively no mixed layer.

6.6 Degradation Rate

The example calculation conservatively assumed no degradation.

6.7 Results

The calculations using the SEDCAM equation and input values listed above were carried out using a 1-year time step for 20 years. The SEDCAM-predicted concentration of PCBs in the cap depositional area at the end of 20 years was 20.25 μg/kg. Since the upstream sediment concentration was assumed to be 20 μg/kg, the initial evaluation shows that at current trends, stormwater will contribute 0.25 μg/kg over 20 years. This increase is insignificant relative to ambient concentrations, especially considering the conservative assumptions that were used to complete the modeling.

6.8 Initial Sensitivity Analysis

A detailed sensitivity analysis will be conducted during the recontamination evaluation, however an initial sensitivity analysis was conducted to better understand the effects of assumed or estimated parameters on the model output.

6.8.1 Sedimentation

As noted above, when the lowest net sedimentation rate (3.81 cm/yr and related upstream sedimentation load of 1,429,678 kg/yr) is used in the calculation, the predicted PCBs concentration after 20 years is 20.25 μg/kg. Raising the sedimentation rate to the average of the estimated range of values (9.53 cm/yr and upstream sedimentation load of 3,574,828 kg/yr), generates a PCBs concentration of 20.10 μg/kg; raising the sedimentation rate to the maximum value of the estimated range (15.24 cm/yr and upstream sedimentation load of 5,719,978 kg/yr) generates a PCBs concentration of 20.06 μg/kg.

6.8.2 Size of Depositional Area

The example calculation assumed that sediment is deposited over the depositional area. This area is approximately 280,452 square feet and is used in calculating the sedimentation loads. When the size of the depositional area is decreased to 138,753 square feet, representing the portion of the depositional area within the sediment cap boundary, the net sedimentation rate decreases significantly (from 1,432,409 kg/yr to 708,681 kg/yr) and the predicted PBCs concentration after 20 years is estimated as 20.51 μg/kg. When sediment is assumed to settle over the entire sediment cap area (386,484 square feet), the predicted PCBs concentration decreases to 20.18 μg/kg.

6.8.3 Upstream Sediment PCBs Concentration

The ambient concentration of PCBs established in the ROD was 10 to 20 μg/kg and the example calculation used the maximum value of 20 μg/kg, which estimated the PCBs concentration in sediment after 20 years as 20.25 μg/kg. It should be noted that this concentration is slightly above ambient; however this result is not considered to show significant recontamination, because the contribution from the

Zidell site is insignificant relative to the contribution of upstream sources, which Zidell cannot control.

When the minimum value of the range of upstream sediment PCBs concentration is used, the result is 10.26 μg/kg; when the median value of 15 μg/kg is used, the PCBs concentration after 20 years is predicted to be 15.26 μg/kg.

6.8.4 Initial PCBs Concentration in Cap Material

The example calculation used 10 μg/kg, representing a conservative PCBs concentration in the cap material. This assumption generated a PCBs concentration in the sediments after 20 years of 20.25 μg/kg. When the initial PCBs concentration in cap material is assumed to be 1 μg/kg, the SEDCAM-predicted PCBs concentration after 20 years is still 20.25 μg/kg. This shows that the model's sensitivity is not affected by the range of values under consideration, given the below conservative assumption of a thin mixed layer depth. The concentration of PCBs in the cap material is a significant parameter when or if the mixed layer depth is assumed to be significant (i.e., approximately 25 cm), as the model assumes that the cap material with lower PCBs concentrations is mixed with the sediment being deposited over the cap from upstream and from stormwater discharges (i.e., with higher PCBs concentrations).

6.8.5 Mixed Layer

The recontamination evaluation will assume and incremental increase of the mixed layer, proportional to the estimated sedimentation rate, to better represent sediment accumulation over the armor layer. The example calculation simplified the sediment accumulation and mixing process and assumed a constant 0.1 cm mixed layer. This assumption generated a PCBs concentration in sediments of 20.25 μg/kg. When a mixed layer depth of 25 cm is input into the model, the predicted PCBs concentration is 19.77 μg/kg. This shows that the model is sensitive to this parameter and that a thick mixed layer results in PCBs concentrations below the ambient levels, even after 20 years.

LIMITATIONS

The services undertaken in completing this work plan were performed consistent with generally accepted professional consulting principles and practices. No other warranty, express or implied, is made. These services were performed consistent with our agreement with our client. This work plan is solely for the use and information of our client unless otherwise noted. Any reliance on this work plan by a third party is at such party's sole risk.

Opinions and recommendations contained in this work plan apply to conditions existing when services were performed and are intended only for the client, purposes, locations, time frames, and project parameters indicated. We are not responsible for the impacts of any changes in environmental standards, practices, or regulations subsequent to performance of services. We do not warrant the accuracy of information supplied by others, or the use of segregated portions of this work plan.

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FIGURES

MAUL FOSTER ALONGI

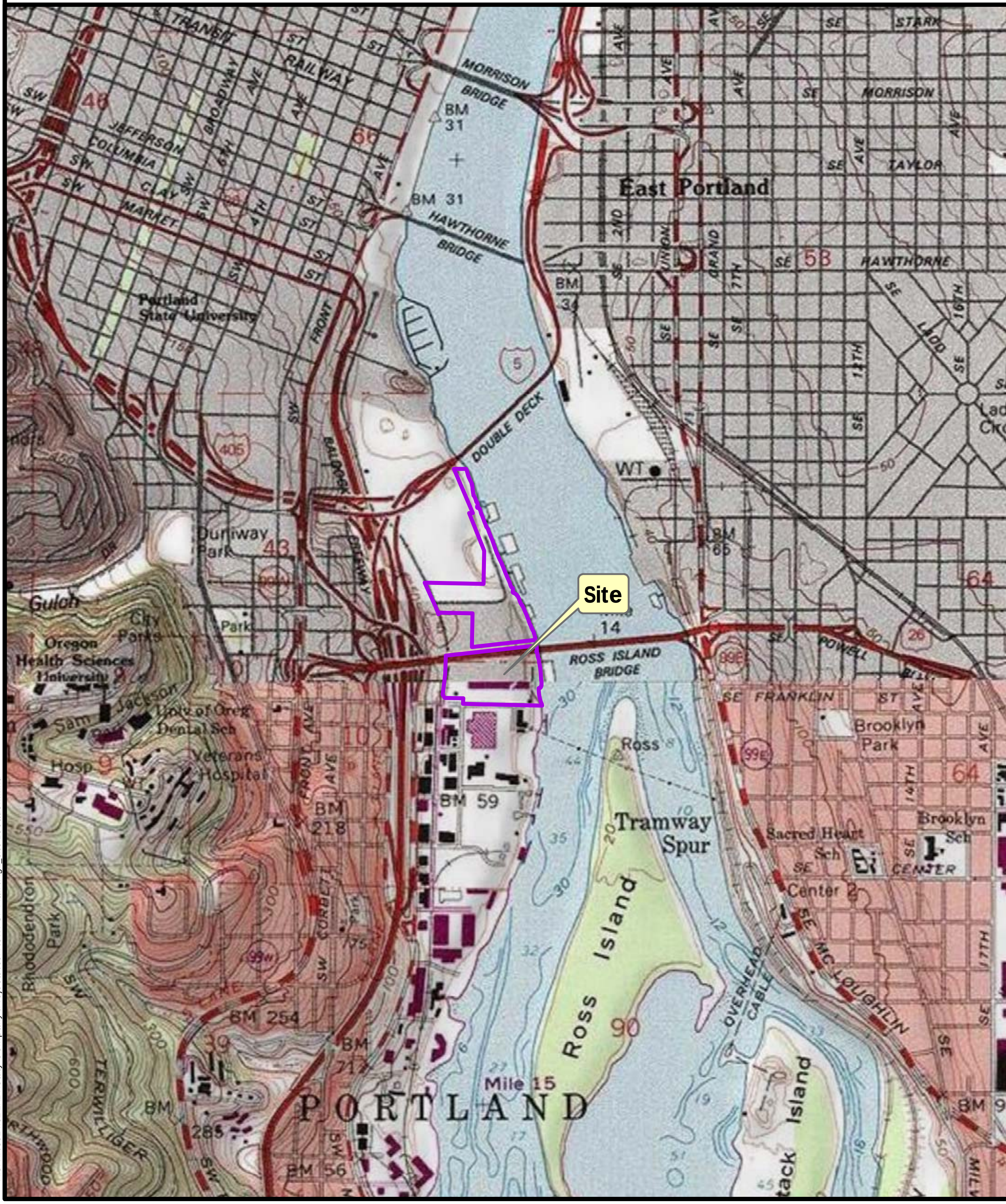
0 1,500 3,000
Feet

N

Figure 1
Site Location
Zidell Marine Corporation
Portland, Oregon

Site Address: 3121 SW Moody Ave, Portland, Oregon
Source: USGS (1990) 7.5 Minute Topo Quad: Portland
Sections 3 & 10, Township 1 South, Range 1 East

Zidell Marine Corporation Parcels

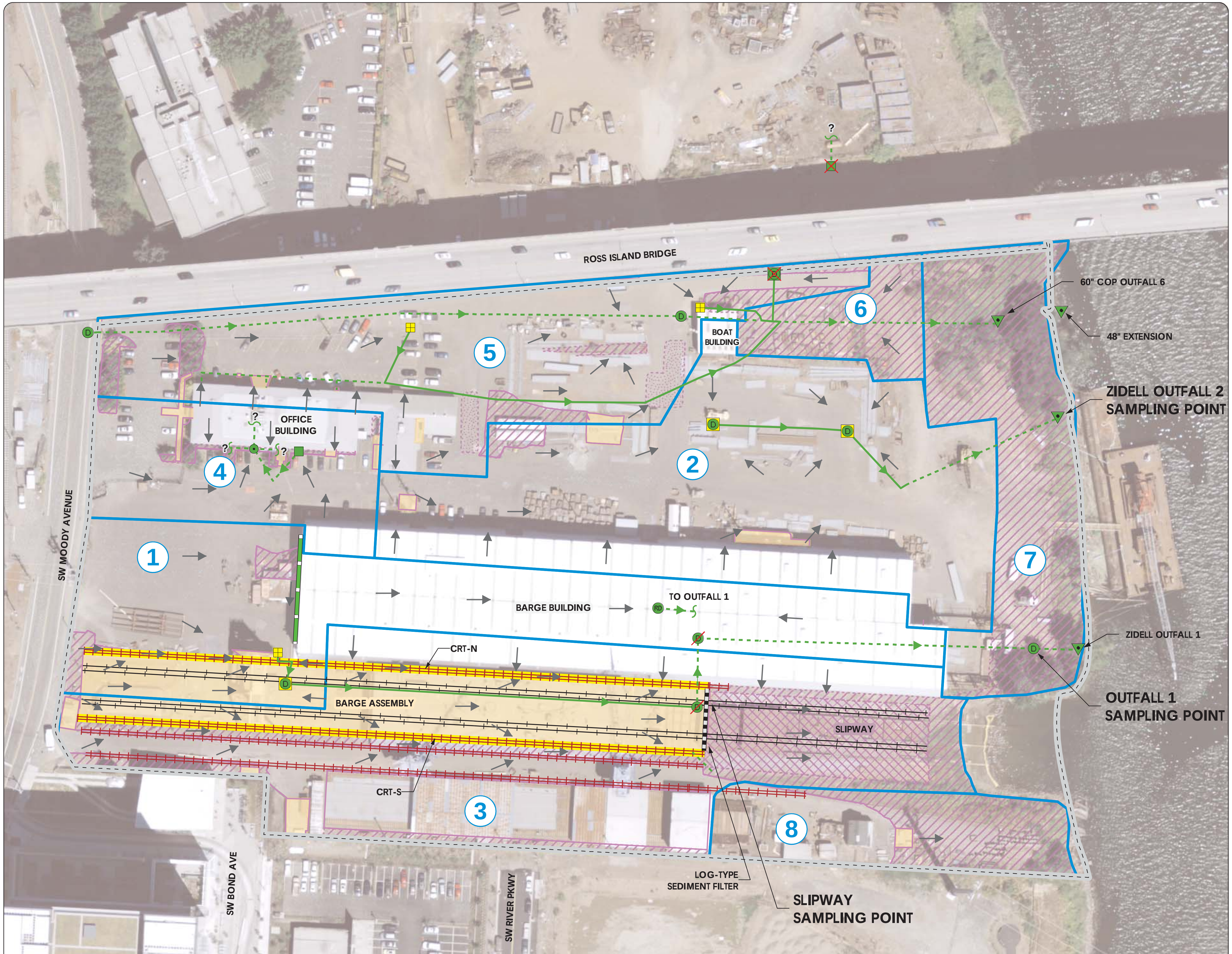


File: X:\8014.01 ZRZ Realty Company\Projects\09A\SWPCP Plan\Fig1_Site Location.mxd

Project: 8014.01.17/09A Produced By: R. Maronn Approved By: A. Banasik

Figure 2
Stormwater System

ZRZ Realty Company
Portland, Oregon



Legend

- Catch Basin (CB)
- Catch Basin with Filter
- Decommissioned Catch Basin
- Storm Manhole (MH)
- Storm Manhole Under Pavement
- Storm Manhole with Slotted Lid & Filter
- Decommissioned Storm Manhole
- Roof Downspout
- Outfall (OF)
- Standpipe (SP)
- Surface Flow Direction
- Storm Line
- Approximate Location of Storm Line
- Trench Drain
- Sled Rail Track
- Crane Rail
- Crane Rail Track Channel
- Site Boundary
- Curb or Edge of Pavement (Surveyed)
- Curb or Edge of Pavement (Approximate)
- Concrete Slab
- Drainage Area Boundary
- Alligatored Pavement Area
- Pervious Area
- Pervious Area Covered by Steel Plates
- 1 Drainage Area

0 50 100
Feet

Source: Aerial photograph (2006) and taxlot information (2007) obtained from Metro Data Resource Center; stormwater and sanitary sewer system locations are based on line locations marked by River City Environmental and surveyed by Olson Engineering unless designated as approximate (2007); crane rail tracks and rail lines obtained from survey by Olson Engineering 2007); all other features are based on field observation and are approximate.

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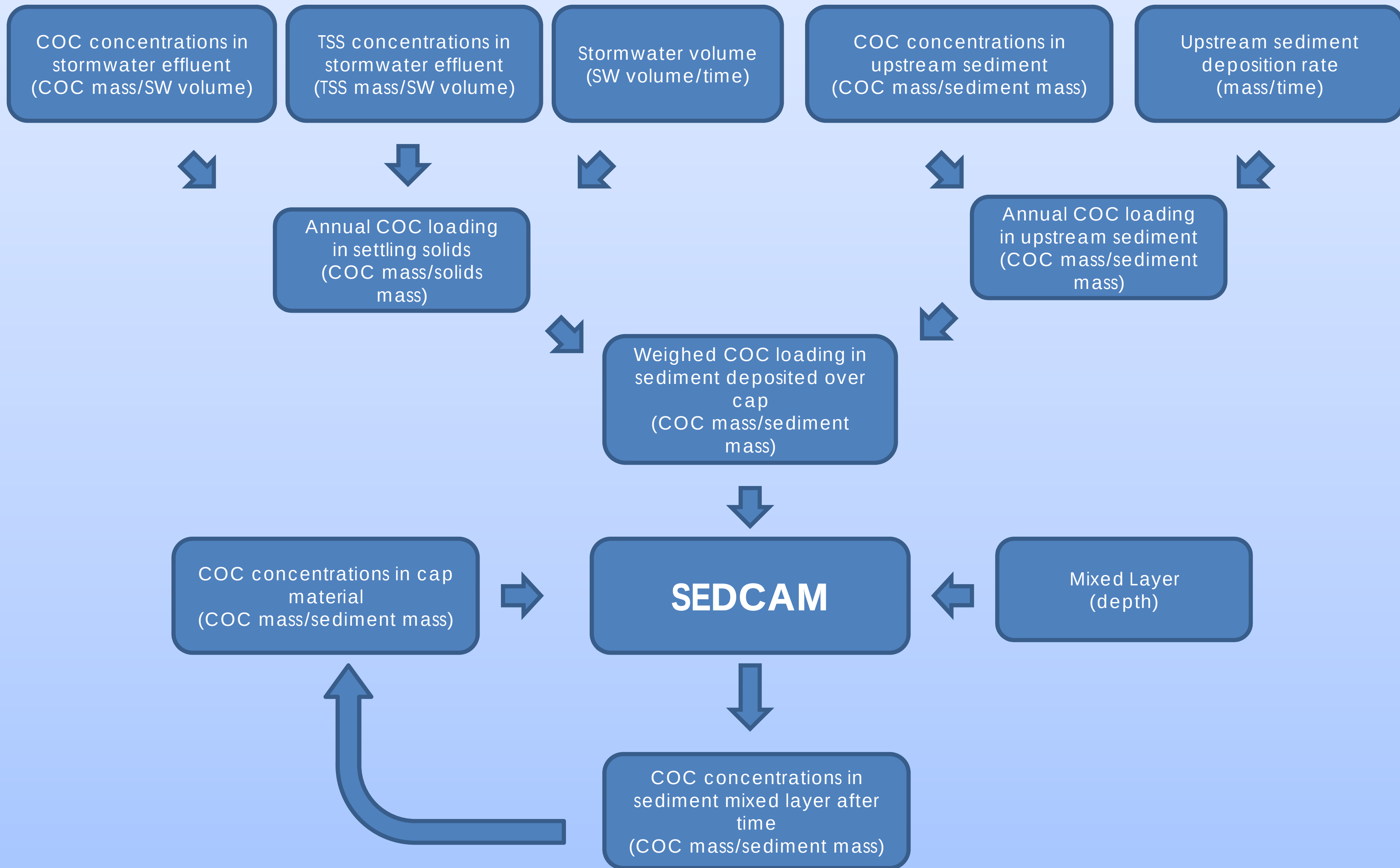
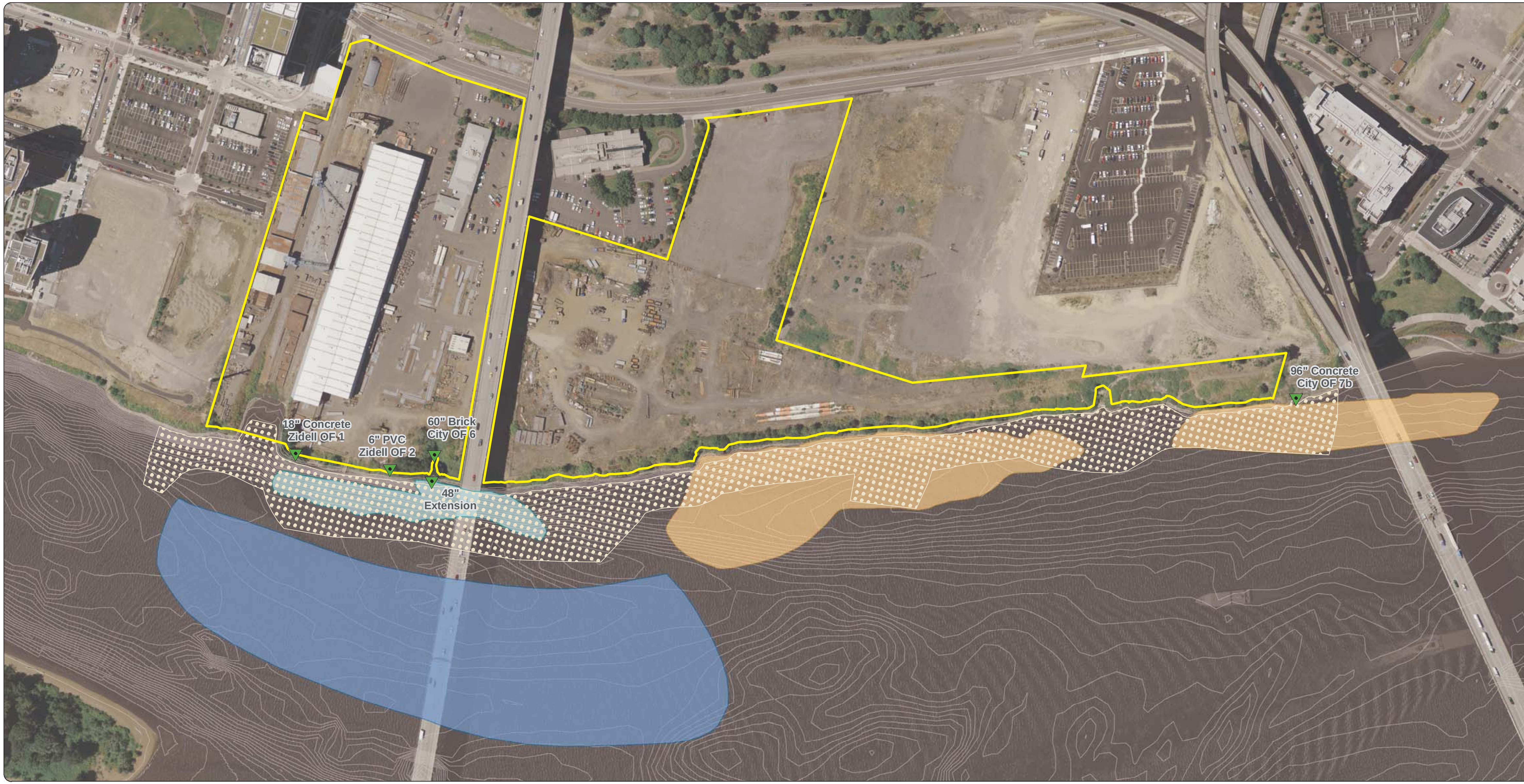
Project: 8014.01.21/05 Produced By: R. Maroni Approved By: A. Banasik Print Date: 01-04-2010 File: X:\8014.01 ZRZ Realty Company\21\05\Projects\Recontamination Evaluation Work Plan\Fig2_Stormwater System.mxd

Figure 3
Recontamination Evaluation Approach
ZRZ Realty Company
Portland, Oregon



File: X:\8014.01 ZRZ Realty Company\21\05\Projects\Recontamination Evaluation Work Plan\Fig4_Estimated Depositional and Erosional Areas.mxd Print Date: 01-04-2010 Approved By: A. Banasik Produced By: R. Maronn Project: 8014.01.21/05



Source: Aerial photograph (2007) obtained from Metro Data Resource Center; upland and bathymetric contours are compiled from upland surveys from Olson Engineering, Inc. (December 2007), Metro Data Resource Center (2001), and as-built survey data for the south waterfront (2007) south of Zidell, as well as bathymetry mapping from Solmar Hydro (December 2007), Olson Engineering, Inc. (April 2007), and the Lower Willamette Group (February 2004), and are based on the City of Portland vertical datum; property boundary and outfall locations surveyed (2007) by Olson Engineering unless designated as approximate

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Legend

- Outfall
- Bathymetry (2-Foot Interval)
- Proposed Sediment Cap (386,484 SF)
- Depositional Area
- Erosional Area
- Stable Area
- ZRZ Property Boundary

Figure 4
Estimated Depositional and Erosional Areas

ZRZ Realty Company
Portland, Oregon

0 125 250
Feet

APPENDIX A

STORMWATER SAMPLING PLAN

STORMWATER SAMPLING PLAN

This Stormwater Sampling Plan (SSP) outlines stormwater sampling requirements for the Zidell Waterfront Property to evaluate the effectiveness of the implemented source control measures. The SSP supplements the sampling requirements listed in the National Pollutant Discharge Elimination System 1200-Z General Permit (permit) issued to Zidell. To the extent possible, SSP and permit sampling will be conducted simultaneously. The SSP was prepared in accordance with the DEQ's *Guidance for Evaluating the Stormwater Pathway at Upland Sites* dated January 2009.

Sampling Locations

Stormwater will be collected and analyzed to evaluate the effectiveness of implemented source control measures and the potential for site-related contaminants to impact the sediment cap in the Willamette River via stormwater runoff. Sampling points for Zidell OF1, Zidell OF2, and the barge slipway are shown on Figure 2. These sampling locations represent the farthest-downstream accessible locations in each stormwater system, providing data representative of stormwater discharged to the river.

Zidell OF1 sampling point is the farthest-downstream manhole (MH-1D) in the OF1 stormwater system. Samples are collected from this location because the outfall end-of-pipe is inaccessible for most of the year (i.e., the over-land access route to the outfall is underwater and access from top of bank is not feasible). The Zidell OF2 sampling point is the end-of-pipe outfall. The slipway sampling point was installed recently to collect representative samples of sheet flow being discharged to the slipway and the Willamette River. The sampling locations coincide with the sampling locations identified in the permit.

Per DEQ's request, Zidell will continue to collect samples from MH-1A, the historical sampling location for OF1, to provide a means of evaluating the effectiveness of the recent source control measures and identify potential source areas by comparing the sample results from MH-1A to sample results in the OF1 downstream sampling location, MH-1D. However, it is unlikely that Zidell will be able to collect stormwater samples from this location, as the recent improvements to enhance infiltration in the crane rail track channels have eliminated discharges from the channels and into MH-1A during typical rain events. The manhole is fairly deep, does not include a sump and has been equipped with a catch basin filter. The filter structure contains a sample port opening large enough for pump tubing to fit, however water needs to pond in the manhole to allow for sample collection using this method. The MH-1A outlet pipe is 18-inches in diameter, therefore stormwater that drains into the manhole is quickly discharged and does not pond and it is likely that sample collection will not be feasible.

Sampling Schedule

The sampling schedule will conform to the schedule identified in the permit. A sampling period begins on July 1 and runs through June 30 of the following year. During each period, four samples will be collected in accordance with the following schedule:

- Two samples collected between July 1 and December 31
- Two samples collected between January 1 and June 30

Sampling will be conducted according to the above schedule until sources of all site chemicals of concern (COCs) have been controlled. Sources of certain COCs may be controlled in advance of others, therefore the analyte list is subject to change with time (see Analyses Section for more detail).

Storm Event Criteria and Selection

At least two of the four annual sampling events should represent "first flush" conditions. First flush is defined as the first 30 minutes of runoff and discharge conditions. For the remaining two sampling events, samples will be collected within the first three hours of discharge, to the extent practicable.

Additionally, stormwater sampling events should meet the following criteria:

- Antecedent dry period of at least 24 hours (i.e., less than 0.1 inches of rainfall over the 24 hours preceding the storm).

  Recorded rainfall depths can be found at:
  http://or.water.usgs.gov/non-usgs/bes/multnomah.html

- Minimum predicted rainfall of more than 0.2 inches per storm event.

- Minimum expected duration of three hours.

  Rainfall depth and duration predictions can be found at:
  http://www.accuweather.com/us/or/portland/97201/forecast-accupop.asp?partner=accuweather&traveler=0

If samples are collected and it is later determined that the storm event did not meet the above criteria (e.g., there was only 0.15 inches of recorded rainfall), it may still be possible to use the sample if it can be argued that the event was representative. An explanation should be included in the sampling report.

Sampling Methods

Grab samples will be collected directly into laboratory-supplied bottles. Care will be taken to avoid contamination of the sample (i.e., avoid touching the opening of the container or scraping container on the manhole wall/bottom, and ensure that stormwater enters the bottle directly). Bottles will not be overfilled and will be capped as soon as they are filled.

The samples from Zidell OF1 are collected from a manhole (MH-1D, Figure 2), and sample collection requires the use of a pump. The manhole includes a sump to settle out any suspended solids. Samples are collected using a telescoping pole with plastic tubing tied to it. The pole is lowered into the manhole so that the intake end of the tubing is approximately even with the elevation of the outlet pipe (i.e., the tubing intake should not be lowered to the bottom of the sump). Pump tubing will be disposed of after each sampling event (i.e., reuse of tubing is not allowed). Per DEQ request, Zidell will attempt to fill the container for the oil and grease analysis without the use of a pump from this location. A sample bottle tied to the telescoping pole will be used instead of pump and tubing. However, it may be difficult or impossible to collect a sample using this method, as the manhole is over 12 feet deep and it may not be feasible to collect the sample container without overfilling the bottle and spilling the sample preservative.

The samples from Zidell OF2 are collected by filling sample bottles from stormwater discharging from the end of the outfall pipe. Sampling containers should be filled with care, especially in avoiding overfilling the bottles, as the flows from this outfall may be relatively high at times. It is important not to overfill sampling bottles that contain preservatives.

The samples from the slipway are collected into a 2-inch PVC pipe from a sampling point that conveys a representative portion of the sheet flow that discharges to the slipway. Sampling bottles are filled from the end of the 2-inch pipe.

To analyze the samples for dissolved parameters (e.g., dissolved metals and butyltins), stormwater from all three sampling locations must be filtered in the field by attaching a filter to the pump tubing. A separate filter and tubing should be used for each sampling location to avoid sample contamination. For samples collected from Zidell OF2 and the slipway, where a pump is not necessary or is difficult to use (e.g., use of pump at the Zidell OF2 sampling location is difficult because of access restriction in the riverbank), unfiltered stormwater may be collected into a clean, unpreserved container and filtered immediately following sample collection. The filtered sample should be labeled as "filtered."

Field Documentation

The following information will be recorded in a field notebook at the time of sample collection:

- The time rainfall began and when runoff was first observed at the sampling location
- Weather information and predicted rainfall and duration
- Time and date of sampling
- Visual observations of the discharge
- Field parameters (e.g.., pH)
- Any relevant activities occurring just before or during sampling (e.g., welding, painting)

Samples should be photographed and submitted to the DEQ with the monitoring reports.

Analyses

Stormwater sampling parameters, standard method reporting limits (MRLs) and Portland Harbor Joint Source Control Strategy (JSCS) screening level values (SLVs) are listed in the following table. Zidell will request that the laboratory attempt to achieve MRLs that are below the SLVs for stormwater, if possible.

Parameter	JSCS SLV[1] (ug/L)	Method Reporting Limits (ug/L)
Metals (USEPA Methods 200.8 and 7470)		
Arsenic	0.14	1
Antimony	64	0.5
Barium	No Value	10
Beryllium	No Value	0.1
Cadmium	0.094 (dissolved) 0.38 (total)	0.1
Chromium	No Value	1
Copper	2.7 (dissolved) 3.6 (total)	0.5
Lead	0.54	0.1
Mercury	No Value (dissolved) 0.0146 (total)	0.05
Nickel	16 (dissolved) 49 (total)	0.5
Silver	No Value (dissolved) 0.12 (total)	0.1
Zinc	36 (dissolved) 33 (total)	100
Butyltins(Krone MJ132 Method)		
Tributyltin	0.072	0.050
PAHs (USEPA Method 8270C-SIM)		
Benzo(a)anthracene	0.0018	0.02
Benzo(a)pyrene	0.0018	0.02
Benzo(b)fluoranthene	0.0018	0.02
Benzo(k)fluoranthene	0.0018	0.02
Chrysene	0.0018	0.02
Dibenz(a,h)anthracene	0.0018	0.02
Indeno(1,2,3-cd)pyrene	0.0018	0.02
Total PAHs	0.0018	0.02
PCBs (USEPA Method 8082)		
Aroclor 1242	0.053	0.01
Aroclor 1254	0.033	0.01
Aroclor 1260	94	0.01
Total PCBs[2]	0.0000064	0.01
TOC (USEPA Method 415.1)	No Value	110
TSS (USEPA Method 160.2)	No Value	5000
pH (Metered)	No Value	No Value
[1]Lowest value of human health and ecological SLV.		
[2] Total PCBs is the sum of all detected Aroclor concentrations or the highest MRL, if no detected concentrations are reported.		

Sample container requirements and holding times are listed in the following table.

Parameter	Container Type	Preservation and Handling	Maximum Holding Time
TOC	500-ml HDPE	H_2SO_4: cool to 4°C	28 days
TSS	250-ml HDPE	Cool to 4°C	Seven days
Total Metals	500-ml HDPE	HNO_3; cool to 4°C	Six months (28 days for mercury)
Dissolved Metals	500-ml HDPE (field-filtered samples)	HNO_3; cool to 4°C	Six months (28 days for mercury)
PAHs	Amber 1-liter glass	Cool to 4°C	Seven days until extraction, 40 days after extraction
Butyltins	1-liter Polycarbonate	Cool to 4°C	Seven days until extraction, 40 days after extraction
PCBs	Amber 1-liter glass	Cool to 4°C	Seven days until extraction, 40 days after extraction

If any individual parameter concentrations are consistently below the respective SLVs during four or more consecutive stormwater sampling events, the analyte list may be revised for subsequent stormwater sampling, following consultation with the DEQ.

Sample Transport and Chain-of-Custody Procedures

After sample containers have been filled, they will be packed on ice in coolers and transported to the laboratory. Chain-of-custody procedures will begin in the field and will track delivery of the samples to laboratories. Specific procedures are as follows:

- Individual sample containers will be packed safely to prevent breakage.
- A completed chain-of-custody form will be enclosed in a plastic bag and placed inside the cooler.

Upon transfer of samples to the laboratory, the chain-of-custody form will be signed by the persons transferring custody of the coolers. Upon receipt of samples at the laboratory, the condition of the samples will be recorded by the receiver.

Quality Assurance and Control

Objectives

The purpose of this quality assurance and quality control (QA/QC) section is to describe the procedures that will be used to direct the investigation process so that the following conditions are met:

- Data collected are high-quality, representative, and verifiable.
- Use of resources is cost-effective.

- Data is useful to Zidell and the DEQ to support the source control evaluation and recontamination evaluation.

Typically, QA/QC objectives are categorized under precision, accuracy, representativeness, completeness, and comparability (PARCC) parameters. Routine analytical procedures to be used for measuring precision and accuracy include use of duplicate analyses, standard reference materials, surrogate spikes, matrix spikes (MSs), method blanks, and laboratory control samples (LCSs). Surrogate spikes, MSs, method blanks, and LCSs (blank spikes) will be analyzed at the minimum frequencies specified below. Additional spikes and duplicate analyses may be performed. For the purposes of laboratory analysis, a sample "batch" is considered to be 20 or fewer samples of a single matrix that are extracted or prepared together or are received in the same shipment.

- Surrogate spikes: Every sample analyzed for organic compounds will be spiked with selected nontarget analytes and analyzed to evaluate laboratory performance on individual samples.

- MSs and matrix spike duplicates (MSDs): One of every 20 samples will be spiked with selected target analytes and analyzed. MSs will be analyzed for inorganic analytes, and both MSs and MSDs will be analyzed for organic analytes. If fewer than 20 samples are analyzed, at least one sample per matrix will be spiked.

- Method blank: A method blank will be analyzed at a frequency of 5 percent of the total number of samples (i.e., one of every 20 samples), one per batch of samples, or one per day, whichever is greater.

- LCSs and laboratory control sample duplicates (LCSDs): One of every 20 samples will be spiked with selected target analytes and analyzed. An LCS will be analyzed for inorganic analytes, and both LCS and LCSDs will be analyzed for low-concentration, organic analytes in water. If fewer than 20 samples are analyzed, at least one LCS per matrix will be analyzed.

Quality Assurance Samples

To ensure that samples are representative of the stormwater at the site, QC samples (i.e., field duplicates) will be collected in the field. One field duplicate sample will be collected and analyzed for the full suite of parameters. Field duplicates will be collected by splitting an individual sample into two separate sample containers and labeled as two different samples.

Field Instrumentation

A pH meter will be used during the sampling activities. All pH measurements are made to the nearest 0.1 pH standard unit. The pH meters and probes are maintained according to factory specifications. Field instrument calibration and preventive maintenance will follow the manufacturers' guidelines, and any deviation from the established guidelines will be documented. Generally, the pH meter will be calibrated on the day of sampling, before work begins. Field personnel may decide to calibrate more than once a day if inconsistent or unusual readings occur, or if conditions warrant more frequent calibration. Calibration will be completed with standard buffer solutions that bracket the pH range of the samples (i.e. pH 7.0 and 4.0 buffers for freshwater samples, unless the pH of the samples is expected to be above 7.0). Calibration activities will be recorded in field notebooks.

Analytical Laboratory Instrumentation

Samples will be analyzed by Specialty Analytical (SA) of Clackamas, Oregon, and Columbia Analytical Services (CAS) of Kelso, Washington.

Specific laboratory instrument calibration procedures, frequency of calibration, and preparation of calibration standards will be according to the method requirements as developed by the USEPA, following procedures presented in SW-846[1].

Preventive maintenance of laboratory equipment will be the responsibility of the laboratory personnel and analysts. This maintenance includes routine care and cleaning of instruments and inspection and monitoring of carrier gases, solvents, and glassware used in analyses. The preventive maintenance approach for specific pieces of equipment will follow the manufacturers' specifications and good laboratory practices. Maintenance is documented by the laboratories in the instrument notebooks.

Precision and accuracy data will be examined by the laboratories for trends and excursions beyond control limits to determine evidence of instrument malfunction. Maintenance will be performed when an instrument begins to change as indicated by the degradation of peak resolution, shift in calibration curves, decrease in sensitivity, or failure to meet one or another of the quality control criteria.

Data Validation

Data quality will be determined, using the data validation procedures described below. The results of the evaluation will be used to determine if the project data quality objectives have been met. After the analytical data is received from the laboratory, the data will be validated under the supervision of the project analytical QA manager. The data will be examined for precision, completeness, accuracy, and adherence to standard operating procedures. For inorganic and organic analyses, the following information will be reviewed during data validation:

- Sampling locations and blind sample numbers
- Sampling dates
- Requested analysis
- Laboratory service request number(s)
- COC documentation
- Sample preservation
- Holding times
- Method blanks
- Surrogate recoveries (organic analyses only)
- MS/MSD results
- Laboratory duplicates (inorganic analyses only)
- Field duplicates

[1] USEPA. 1986a. Test methods for evaluating solid waste. U.S. Environmental Protection Agency, Office of Solid Waste and Emergency Response. SW-846. September (update 1, July 1992; update 2a, August 1993; update 2, September 1994; update 2b, January 1995).

- LCSs (organic analyses only)
- MRLs above target levels
- Any additional comments or difficulties reported by the laboratory
- Overall assessment

Laboratory analytical data will be reported in a Tier II½ format to facilitate data validation. Data will also be received electronically from SA and CAS and imported into the site database (GIS-Key). The laboratory will routinely archive raw laboratory data, including initial and continuing calibration data, chromatograms, quantitation reports, blank sheets, and sampling logs, and will provide these data in addition to the deliverables listed above, if requested.

As part of the data validation process, the data will be reviewed and data qualifiers will be assigned to sample results, following USEPA procedures for inorganic data[2] and organic data[3], as applicable. Data qualifiers will be used to classify sample data as to its conformance to QC requirements. The most common qualifiers are listed below:

- J—Estimate, qualitatively correct but quantitatively suspect
- R—Reject, data not suitable for any purpose
- U—Not detected at a specified detection limit

Poor surrogate recovery, blank contamination, or calibration problems, among other things, can cause the sample data to be qualified. Whenever sample data are qualified, the reasons for the qualification will be stated in the data validation report.

QC criteria not defined in the guidelines for evaluating analytical data are adopted, where appropriate, from the analytical method.

The results of the data validation review will be summarized in a data validation report for each batch of samples. The quality of the analytical data, as defined by precision and accuracy, will be assessed and compared to data quality objectives for the project.

Data Evaluation and Reporting

Within 30 days of receipt of the laboratory analytical report, Zidell will submit a letter report summarizing results of the stormwater sampling. The letter report will include a table comparing analytical results with the JSCS SLVs and will include copies of the laboratory analytical report and chain-of-custody documentation. Sampling results will be tabulated using the table included in Appendix D of the DEQ's *Guidance for Evaluating the Stormwater Pathway at Upland Sites*. The table will be submitted electronically as well as in hard copy formats. Detected concentrations will be in bold

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[2] USEPA. 1994a. USEPA contract laboratory program national functional guidelines for inorganics data review. U.S. Environmental Protection Agency, Office of Emergency and Remedial Response. EPA 540/R-94/013. February.

[3] USEPA. 1994b. USEPA contract laboratory program national functional guidelines for organics data review. U.S. Environmental Protection Agency, Office of Emergency and Remedial Response. EPA 540/R-94/012. February.

text and concentrations exceeding the respective SLVs will be highlighted. Since the DEQ table format does not include dissolved parameters, results of dissolved metals and butyltins will be presented at the bottom of the table, as will TSS, TOC, and pH results.

When calculating and reporting total PAHs and PCBs, the following methods will be used:

- Where no individual compounds/isomers are detected, the single highest detection limit shall represent the sum of the respective compounds/isomers.

- Where one or more individual compounds/isomers are detected, only the detected concentrations will be added to represent the group sum. Summation is performed on all individual isomers (i.e., not just the COCs).

The report will include a rainfall hydrograph, including 24 hours preceding the rain event and the duration of the storm. The hydrograph should note the time runoff/discharge was first observed and the sample collection time to substantiate first flush events. Rainfall information may be obtained from the City of Portland Thomas rain gauge, located at 4026 SW Macadam Avenue: http://or.water.usgs.gov/non-usgs/bes/multnomah.html.

The report will note any deviations from the Stormwater Sampling Plan, unusual circumstances or site activities, observed evidence of contamination, and a discussion of the SLV exceedances, if any. Sample photographs will be attached to the report.

Additionally, Zidell will submit a Stormwater Source Control Evaluation Report, summarizing the results of all four 2009 sampling events and evaluating the effectiveness of the implemented source control measures and identifying any additional work or data, if any, needed to control the COCs sources at the site.

The DEQ Cleanup Program will be copied on all submittals related to the permit, including Stormwater Pollution Control Plans, data submittals and action plans.

APPENDIX B

EXAMPLE RECONTAMINATION EVALUATION

Table B-1
PCBs Mass Loading Calculations
ZRZ Realty Company
Portland, Oregon

Outfall 1	
Runoff Volume =	6,679,921 L/yr
TSS Mass Loading =	27.9 kg/yr

Outfall 2	
Runoff Volume =	8,442,677 L/yr
TSS Loading =	362.9 kg/yr

Slipway	
Runoff Volume =	5,226,419 L/yr
TSS Loading =	31.36 kg/yr

Parameter	OUTFALL 1 04/28/09	OUTFALL 1 06/04/09	OUTFALL 1 Geometric Mean Concentrations	Annual Mass Loading in Stormwater	OUTFALL 2 04/28/09	OUTFALL 2 06/04/09	OUTFALL 2 Geometric Mean Concentrations	Annual Mass Loading in Stormwater	SLIPWAY 04/28/09	SLIPWAY Concentrations	Annual Mass Loading in Stormwater	Combined Annual Mass Loading in Stormwater	Weighted Average Concentrations in Stormwater Solids
Units	µg/l	µg/l	µg/l	µg/yr	µg/l	µg/l	µg/l	µg/yr	µg/l	µg/l	µg/yr	µg/yr	µg/kg
PCBs Aroclors													
Aroclor 1016	0.00285 U	0.00291 U	0.001440	9,619	0.00287 U	0.0032 U	0.00152	12,793	0.00291 U	0.001455	7,604	30,016	71
Aroclor 1221	0.00285 U	0.00291 U	0.001440	9,619	0.00287 U	0.0032 U	0.00152	12,793	0.00291 U	0.001455	7,604	30,016	71
Aroclor 1232	0.00285 U	0.00291 U	0.001440	9,619	0.00287 U	0.0032 U	0.00152	12,793	0.00291 U	0.001455	7,604	30,016	71
Aroclor 1242	0.00285 U	0.00291 U	0.001440	9,619	0.00287 U	0.0032 U	0.00152	12,793	0.00291 U	0.001455	7,604	30,016	71
Aroclor 1248	0.00285 U	0.00291 U	0.001440	9,619	0.00287 U	0.0032 U	0.00152	12,793	0.00291 U	0.001455	7,604	30,016	71
Aroclor 1254	0.00285 U	0.00291 U	0.001440	9,619	0.00287 U	0.0032 U	0.00152	12,793	0.00291 U	0.001455	7,604	30,016	71
Aroclor 1260	0.00285 U	0.00291 U	0.001440	9,619	**0.0688**	0.0032 U	0.01049	88,580	**0.0524**	0.0524	273,864	372,063	881
Aroclor 1262	0.00285 U	0.00291 U	0.001440	9,619	0.00287 U	0.0032 U	0.00152	12,793	0.00291 U	0.001455	7,604	30,016	71
Aroclor 1268	0.00285 U	0.00291 U	0.001440	9,619	0.00287 U	0.0032 U	0.00152	12,793	0.00291 U	0.001455	7,604	30,016	71
Total PCBs	0.00285 U	0.00291 U	0.001440	9,619	**0.0688**	0.0032 U	0.01049	88,580	**0.0524**	0.0524	273,864	372,063	881
Additional Analytes													
Total Suspended Solids	**7,000**	**5,000** U	4,183	--	**84,000**	**22,000**	42,988	--	**6,000**	6,000	--	--	--

Table B-2
Preliminary Calculation of Stormwater Runoff Volumes
ZRZ Realty Company
Portland, Oregon

Annual Rainfall (ft) =	**2.93**
Fraction of Rainfall Producing Runoff =	**0.9**
Impervious Fraction of Drainage Basin =	**1**
Runoff Coefficient =	**0.95**

Drainage Area Description	Drainage Area (sf)	Average Annual Runoff Volume (cf)	Average Annual Runoff Volume (L)
Oufall 1	94,090	235,910	**6,679,921**
Outfall 2	118,919	298,164	**8,442,677**
Slipway	73,616	184,577	**5,226,419**

2002 Water Year[1]	
Date	**Total Rainfall[2] (in)**
10/01/02	0.01
10/02/02	0
10/03/02	0.29
10/04/02	0.02
10/05/02	0.01
10/06/02	0
10/07/02	0
10/08/02	0
10/09/02	0
10/10/02	0
10/11/02	0
10/12/02	0
10/13/02	0
10/14/02	0
10/15/02	0
10/16/02	0.08
10/17/02	0
10/18/02	0
10/19/02	0
10/20/02	0
10/21/02	0
10/22/02	0
10/23/02	0
10/24/02	0
10/25/02	0
10/26/02	0
10/27/02	0
10/28/02	0
10/29/02	0
10/30/02	0
10/31/02	0
11/01/02	0
11/02/02	0
11/03/02	0
11/04/02	0
11/05/02	0
11/06/02	0.01
11/07/02	0.32
11/08/02	0.09
11/09/02	0.31
11/10/02	0.09
11/11/02	0.05
11/12/02	0.42
11/13/02	0.35
11/14/02	0

Table B-2
Preliminary Calculation of Stormwater Runoff Volumes
ZRZ Realty Company
Portland, Oregon

2002 Water Year[1]	
Date	**Total Rainfall[2] (in)**
11/15/02	0
11/16/02	0.17
11/17/02	0.01
11/18/02	0.24
11/19/02	0
11/20/02	0
11/21/02	0
11/22/02	0
11/23/02	0
11/24/02	0
11/25/02	0
11/26/02	0
11/27/02	0
11/28/02	0
11/29/02	0
11/30/02	0
12/01/02	0
12/02/02	0
12/03/02	0
12/04/02	0.07
12/05/02	0
12/06/02	0
12/07/02	0
12/08/02	0
12/09/02	0.17
12/10/02	0.31
12/11/02	0.6
12/12/02	0.97
12/13/02	0.22
12/14/02	0.75
12/15/02	0.52
12/16/02	0.69
12/17/02	0.27
12/18/02	0.23
12/19/02	0
12/20/02	0.09
12/21/02	0.22
12/22/02	0.14
12/23/02	0
12/24/02	0.06
12/25/02	0.04
12/26/02	0.46
12/27/02	0.65
12/28/02	0.48
12/29/02	0.21
12/30/02	1.45
12/31/02	0.15
01/01/03	0.11
01/02/03	0.83
01/03/03	0.09
01/04/03	0.51
01/05/03	0
01/06/03	0
01/07/03	0
01/08/03	0
01/09/03	0
01/10/03	0
01/11/03	0.21
01/12/03	0.49
01/13/03	0.39
01/14/03	0
01/15/03	0
01/16/03	0
01/17/03	0
01/18/03	0

Table B-2
Preliminary Calculation of Stormwater Runoff Volumes
ZRZ Realty Company
Portland, Oregon

2002 Water Year[1]	
Date	**Total Rainfall[2] (in)**
01/19/03	0
01/20/03	0
01/21/03	0.01
01/22/03	0.54
01/23/03	0
01/24/03	0.19
01/25/03	0.25
01/26/03	0.36
01/27/03	0.06
01/28/03	0
01/29/03	0.98
01/30/03	0.72
01/31/03	2.33
02/01/03	0.01
02/02/03	0.01
02/03/03	0.01
02/04/03	0
02/05/03	0
02/06/03	0
02/07/03	0
02/08/03	0
02/09/03	0
02/10/03	0
02/11/03	0
02/12/03	0
02/13/03	0
02/14/03	0
02/15/03	0.65
02/16/03	0.32
02/17/03	1.17
02/18/03	0.07
02/19/03	0.11
02/20/03	0.05
02/21/03	0.08
02/22/03	0
02/23/03	0
02/24/03	0
02/25/03	0
02/26/03	0
02/27/03	0
02/28/03	0.07
03/01/03	0.01
03/02/03	0.11
03/03/03	0
03/04/03	0.01
03/05/03	0.09
03/06/03	0.3
03/07/03	1.05
03/08/03	0.32
03/09/03	0.45
03/10/03	0
03/11/03	0
03/12/03	0.41
03/13/03	0.26
03/14/03	0.19
03/15/03	0.16
03/16/03	0.1
03/17/03	0
03/18/03	0.05
03/19/03	0.27
03/20/03	0.01
03/21/03	0.51
03/22/03	0.36
03/23/03	0.22
03/24/03	0

Table B-2
Preliminary Calculation of Stormwater Runoff Volumes
ZRZ Realty Company
Portland, Oregon

2002 Water Year[1]	
Date	**Total Rainfall[2] (in)**
03/25/03	0.25
03/26/03	0.31
03/27/03	0.02
03/28/03	0
03/29/03	0
03/30/03	0
03/31/03	0.13
04/01/03	0.17
04/02/03	0.1
04/03/03	0.25
04/04/03	0.03
04/05/03	0.26
04/06/03	0.2
04/07/03	0.24
04/08/03	0.11
04/09/03	0.05
04/10/03	0.13
04/11/03	0.01
04/12/03	0.77
04/13/03	0.32
04/14/03	0
04/15/03	0.01
04/16/03	0.24
04/17/03	0.36
04/18/03	0
04/19/03	0
04/20/03	0.05
04/21/03	0.11
04/22/03	0
04/23/03	0.66
04/24/03	0.05
04/25/03	0.2
04/26/03	0.06
04/27/03	0
04/28/03	0.11
04/29/03	0.05
04/30/03	0.11
05/01/03	0
05/02/03	0
05/03/03	0.09
05/04/03	0.14
05/05/03	0.06
05/06/03	0
05/07/03	0.6
05/08/03	0.02
05/09/03	0
05/10/03	0
05/11/03	0
05/12/03	0
05/13/03	0
05/14/03	0
05/15/03	0.05
05/16/03	0.37
05/17/03	0.26
05/18/03	0.01
05/19/03	0
05/20/03	0
05/21/03	0
05/22/03	0
05/23/03	0
05/24/03	0.01
05/25/03	0.01
05/26/03	0
05/27/03	0
05/28/03	0

Table B-2
Preliminary Calculation of Stormwater Runoff Volumes
ZRZ Realty Company
Portland, Oregon

2002 Water Year[1]	
Date	**Total Rainfall[2] (in)**
05/29/03	0
05/30/03	0
05/31/03	0
06/01/03	0
06/02/03	0
06/03/03	0
06/04/03	0
06/05/03	0
06/06/03	0
06/07/03	0
06/08/03	0
06/09/03	0
06/10/03	0
06/11/03	0
06/12/03	0
06/13/03	0.14
06/14/03	0
06/15/03	0
06/16/03	0
06/17/03	0
06/18/03	0
06/19/03	0
06/20/03	0
06/21/03	0.07
06/22/03	0.05
06/23/03	0
06/24/03	0
06/25/03	0
06/26/03	0
06/27/03	0
06/28/03	0
06/29/03	0
06/30/03	0
07/01/03	0
07/02/03	0
07/03/03	0
07/04/03	0
07/05/03	0
07/06/03	0
07/07/03	0.06
07/08/03	0
07/09/03	0
07/10/03	0
07/11/03	0
07/12/03	0
07/13/03	0
07/14/03	0
07/15/03	0
07/16/03	0
07/17/03	0
07/18/03	0
07/19/03	0
07/20/03	0
07/21/03	0
07/22/03	0
07/23/03	0
07/24/03	0
07/25/03	0
07/26/03	0
07/27/03	0
07/28/03	0
07/29/03	0
07/30/03	0
07/31/03	0
08/01/03	0

Table B-2
Preliminary Calculation of Stormwater Runoff Volumes
ZRZ Realty Company
Portland, Oregon

2002 Water Year[1]	
Date	**Total Rainfall[2] (in)**
08/02/03	0
08/03/03	0
08/04/03	0
08/05/03	0
08/06/03	0
08/07/03	0
08/08/03	0
08/09/03	0
08/10/03	0.01
08/11/03	0
08/12/03	0
08/13/03	0
08/14/03	0
08/15/03	0
08/16/03	0
08/17/03	0
08/18/03	0
08/19/03	0
08/20/03	0
08/21/03	0
08/22/03	0.03
08/23/03	0
08/24/03	0
08/25/03	0
08/26/03	0
08/27/03	0
08/28/03	0
08/29/03	0
08/30/03	0
08/31/03	0
09/01/03	0
09/02/03	0
09/03/03	0
09/04/03	0
09/05/03	0
09/06/03	0
09/07/03	0.28
09/08/03	0.04
09/09/03	0.5
09/10/03	0.01
09/11/03	0
09/12/03	0
09/13/03	0
09/14/03	0
09/15/03	0
09/16/03	0.28
09/17/03	0.01
09/18/03	0
09/19/03	0.01
09/20/03	0
09/21/03	0
09/22/03	0
09/23/03	0
09/24/03	0
09/25/03	0
09/26/03	0
09/27/03	0
09/28/03	0
09/29/03	0
09/30/03	0

Data Sources:

[1] 50th percentile flow year (Anchor QEA, 2009).

[2] Portland HYDRA Network Thomas Raingage (4026 SW Macadam Avenue)
http://or.water.usgs.gov/non-usgs/bes/thomas.rain

Table B-3
Preliminary Calculation of Sediment Deposition Rates
ZRZ Realty Company
Portland, Oregon

Sediment Density = 90 lbs/cf

Net Sediment Deposition						Average Annual Sedimentation Load		
Area Description	Area (sf)	Annual Deposition Rate[1] (ft/yr)	Annual Deposition Rate (cm/yr)	Annual Deposition Volume (cf/yr)	Annual Deposition Mass (kg/yr)	Annual Mass of Solids Deposited with Stormwater (kg/yr)	Annual Mass of Sediment Deposited from Upstream (kg/yr)	Net Mass of Sediment Deposited (kg/yr)
Depositional Area	280,452	0.13	**3.81**	35,057	**1,432,409**	**422**	**1,431,986**	**1,432,409**
Depositional Area	280,452	0.31	9.53	87,641	3,581,021	422	3,580,599	3,581,021
Depositional Area	280,452	0.50	15.24	140,226	5,729,634	422	5,729,212	5,729,634

NOTES:

[1]Sedimentation rate obtained from bathymetric surveys and reported in Fluvial Evaluation (MFA, 2009).

Table B-4
Example SEDCAM Calculation - PCBs Concentration in Sediment
ZRZ Realty Company
Portland, Oregon

SEDCAM Input Values

Total Stormwater Sedimentation Load =	**422.2**	**kg/yr**
Upstream Sedimentation Load =	**1,431,986**	**kg/yr**
Net Sedimentation Load =	**1,432,409**	**kg/yr**
Mixed Layer Depth =	**0.1**	**cm**
Annual Sedimentation Rate =	**3.81**	**cm/yr**
T_S =	**0.03**	
Time Step =	**1**	**yr**

Parameter	Weighted COC Concentration in Stormwater Solids	COC Concentration in Upstream Sediment	Weighed COC Concentrations in Deposited Sediment/Solids	Initial COC Concentrations in Cap Material	Degradation Rate	Year 1	Year 2	Year 3	Year 4	Year 5	Year 6	Year 7	Year 8	Year 9	Year 10	Year 11	Year 12
Units	µg/kg	µg/kg	µg/kg	µg/kg	yr^{-1}	µg/kg	µg/kg	µg/kg	µg/kg	µg/kg	µg/kg	µg/kg	µg/kg	µg/kg	µg/kg	µg/kg	µg/kg
PCBs Aroclors																	
Total PCBs	881	20	20.25	10	0	20.25	20.25	20.25	20.25	20.25	20.25	20.25	20.25	20.25	20.25	20.25	20.25

Table B-4
Example SEDCAM Calculation - PCBs Concentration in Sediment
ZRZ Realty Company
Portland, Oregon

SEDCAM Input Values

Total Stormwater Sedimentation Load =	422.2 kg/yr
Upstream Sedimentation Load =	1,431,986 kg/yr
Net Sedimentation Load =	1,432,409 kg/yr
Mixed Layer Depth =	0.1 cm
Annual Sedimentation Rate =	3.81 cm/yr
T_S =	0.03
Time Step =	1 yr

Parameter	Weighted COC Concentration in Stormwater Solids	COC Concentration in Upstream Sediment	Weighed COC Concentrations in Deposited Sediment/Solids	Initial COC Concentrations in Cap Material	Degradation Rate	Year 13	Year 14	Year 15	Year 16	Year 17	Year 18	Year 19	Year 20	ROD Sediment Cleanup Levels
Units	µg/kg	µg/kg	µg/kg	µg/kg	yr^{-1}	µg/kg	µg/kg	µg/kg	µg/kg	µg/kg	µg/kg	µg/kg	µg/kg	µg/kg
PCBs Aroclors														
Total PCBs	881	20	20.25	10	0	20.25	20.25	20.25	20.25	20.25	20.25	20.25	20.25	2*